No. 66 January 1996

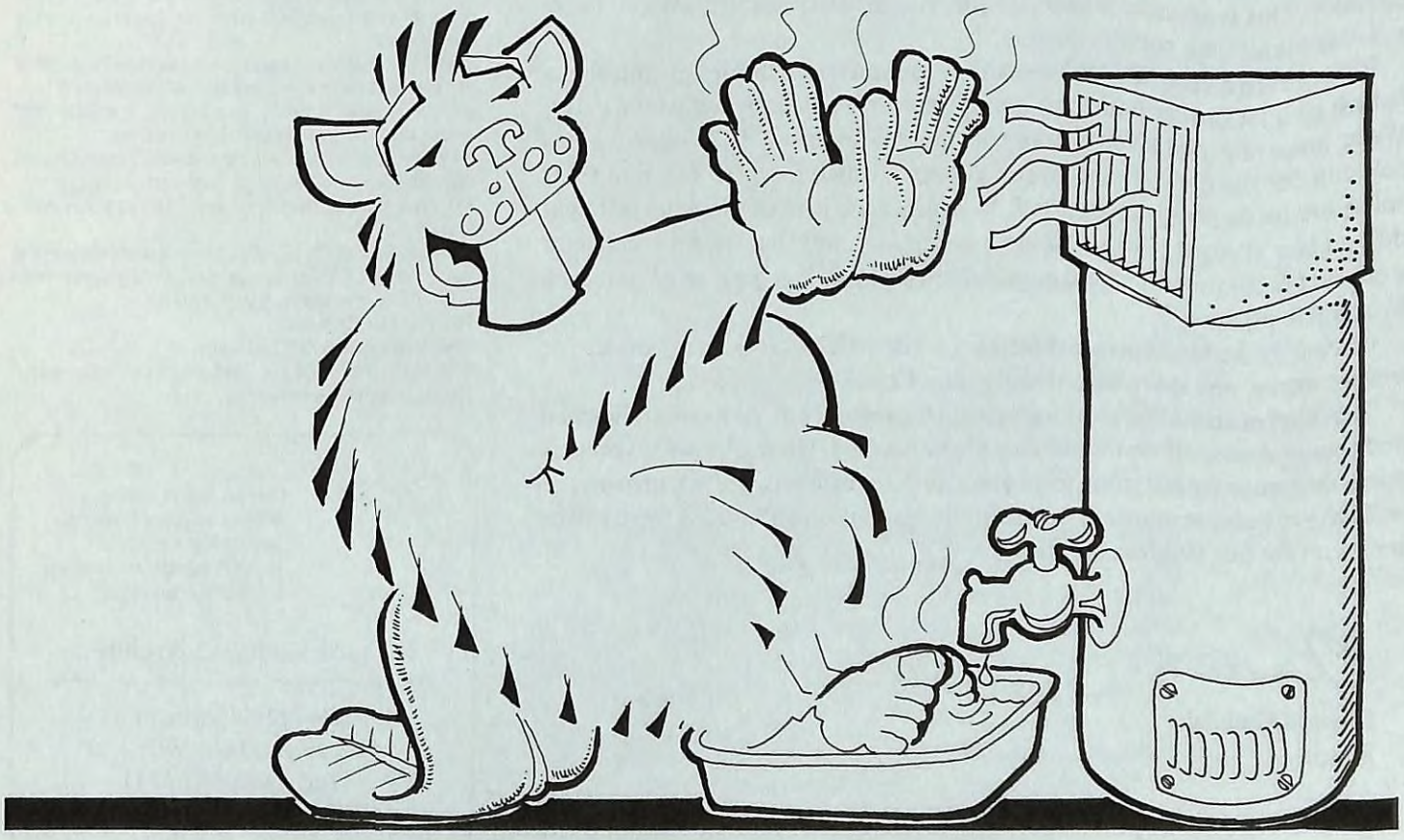
solplan review

the independent journal of energy conservation, building science & construction practice

Contents . . .

Combo Heating Systems 3
Hot Water Heating System Design Manual 4
EcoDesign Resource Centre on the Internet ... soon 5
Wood and Steel Framing: the Environmental Cost 6
Thermal Bridging Through Framing:
the performance penalty 7
Letters to the Editor 8
A Primer On Sustainable Building 10
Flex-Housing Design Competition 10
Building Materials Chemical Emissions 11
Reducing formaldehyde emissions 13
Technical Research Committee News 14
CMHC Builders Series publications; Ice damming; Envirohome; Wall Moisture Problems
Defective Oriented Strandboard (OSB) 15
Health benefits of good housing 16
Global Warming 16
Index to Issues No. 51 - 65 17
Coming Events 19

Combo Heating Systems



From the Editor . . .

Some days it feels already we're overregulated. The thought of more regulations gets most of us seeing red. The drive to impose a new National Energy Code is the latest one concern. It doesn't seem to matter that the principal intent behind the code are the environmental needs to deal with global warming and resource conservation issues.

Industry representatives claim that these new regulations are not necessary as we are already building significantly more energy efficient housing than in the past, and that the marketplace should be the determinant of how far to go. After all, homebuilders support the R-2000 program, and instead of regulations, we should just support the R-2000 program.

It's well and good to say that we all do a great job, so there's no need to ensure that certain minimums are met. I guess that in a perfect world everyone would do the right thing and there would be no need to legislate. Unfortunately, we live in a less than perfect world, and minimum regulations have to be laid down.

I recently encountered an example of how the development industry is not encouraging environmentally responsible practices - in fact they are actively working against environmentally sensitive development. I am referring to restrictive covenants that explicitly spell out that you cannot install a solar collector. This is actually the second subdivision design controls where I saw a clause prohibiting solar collectors.

It's not even a case of a boiler-plate clause stuck into the design guidelines (which go a lot further with regulations than any code or bylaw would dare). When preparing plans for a house in the development, I included a solar collector for the domestic hot water system - which meant 2 4x8 foot solar collectors on the south facing roof. In appearance it would look no different than a glass skylight. I was told in no uncertain terms that the solar collector would not be allowed (it would be permitted if placed "on the ground, screened by suitable planting").

Obviously the developers and their agents don't have any idea of how a solar system works, and more disturbingly, don't care.

That kind of attitude is working against the industry as far as environmental and energy conservation regulations are concerned. No matter what you may think, the issues are not going to go away as the evidence pours in that everyone will have to become more environmentally responsible, otherwise there will be no future for our children and theirs.

Richard Kadulski
Editor

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Editor-Publisher: Richard Kadulski
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Contributors: Kal Minhas, Nelle Maxie, Leo Vaillancourt, Tim Mayo, Don Figley, John Lowood, Tom Hamlin, Ross Monsour
ISSN: 0828-6574
Date of Issue: February 1996
SOLPLAN REVIEW is published 6 times per year by:
the drawing-room graphic services ltd.
Box 86627, North Vancouver, B.C. V7L 4L2
Tel: 604-689-1841 Fax: 604-689-1841
e-mail: solplan@cyberstore.ca

Street address:
208-1280 Seymour St.
Vancouver, B.C. V6B 3N9

Canadian Publications Mail Product Sales Agreement No. 454532
Postage paid in Vancouver, B.C.
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SUBSCRIPTIONS: In Canada 1 year $40.66; 2 years $77.04 (includes GST). USA and other foreign payable in US $ 1 year $46.00, 2 years $88.00.
CHANGE OF ADDRESS: include a mailing label or copy all information off label for faster, accurate processing.
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GST Registration: R105208805
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design & consulting
energy efficient building
consulting services
R-2000 design evaluations
HOT-2000 analysis

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Combo Heating Systems

Every dwelling we build needs some space heating and hot water for domestic use. The usual practice has been to install a separate furnace and water heater. The water heater provides hot water year round, but on average it sits idle for about 22 hours every day of the year. Similarly, the furnace is idle whenever the weather is warm, and the better insulated the house, the shorter the heating season.

As the Advanced Houses showed, one appliance can do both jobs. A single water heater provides both hot water and space heating. The heating loop is designed and installed as any conventional hot water heating system (i.e., hydronic coil, baseboard or radiant floor), and all piping and components comply with the Plumbing Code. This approach is increasingly being used and is referred to as combo systems.

Another approach to combo systems is to tie forced warm air heating with the hot water heater, using a fan coil instead of a furnace. The basic design of a fan coil combo system is shown in figure 1. This type of system has been used in about one million dwellings in the United States over the last twenty years, and up to 60,000 in Ontario over the last ten years. In the past five years, about 2,000 have been installed in B.C.

With today's more energy efficient houses, total heat load is quite small, so this approach is closer to optimizing system design. This is especially the case in multi family buildings (including rowhouses).

What's the benefit of a combo system?

- one gas-burning appliance is used instead of two
- one combustion gas vent is needed
- only one gas permit is required for installation
- chimney heat loss occurs from one appliance only
- a fan coil unit can be easier to install than a conventional furnace and can be located in tight or difficult areas
- a fan coil may require less maintenance than a more complex fuel-burning appliance

However, the lack of a Standard for such systems has meant a lot of arbitrary decisions being made by building authorities. In some areas, where the inspectors had their doubts, they did not allow combo systems. Notable among these was the City of Richmond, B.C. However, after considerable work by industry, they have now accepted the validity of the principle and have allowed 40 units in the Fisher Gardens townhouse project to be heated with a combo forced warm air system.

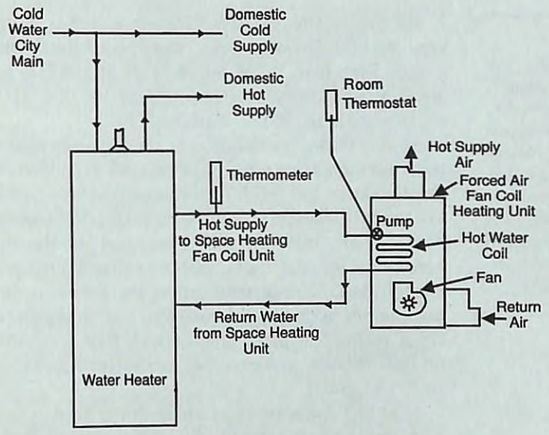


Fig. 1. Typical " COMBO " fan coil system

In the absence of a national standard, and to assist designers and contractors to design, size and install fan coil combo systems, a set of B.C. guidelines were published in June 1995. The *"Combination (COMBO) Forced Air Space and Domestic Hot Water Heating Systems"* guidelines were prepared with the help of the B.C. Building Standards Branch, local building and plumbing officials, industry and other interested parties.

The guidelines are timely, as the B.C.Gas Safety Branch recently issued a directive (DC 36) that now requires the full design of gas fired heating systems (old rules of thumb are no longer acceptable). The Combo guidelines are identified as an accepted method for system design.

The B.C. Building Standards Branch has also advised that acceptance of Combo systems may be done by the authority having jurisdiction under the equivalency provisions of the Building and Plumbing Codes, but that the gas installation must comply with the requirements of the B.C. Gas Safety Act.

Copies of the Combination (COMBO) Forced Air Space and Domestic Hot Water Heating Systems guidelines may be obtained from equipment manufacturers' representatives in B.C. or from BC Gas (phone 604-443-6890 or fax 604-443-6552).

Hot Water Heating System Design Manual

Heat loss calculations ..... is only the starting point. Equipment sizing, distribution layout and control strategies also have to be designed .... rules of thumb and learning on the job alone is no longer good enough.

Heating system design is often considered as being very straight forward. Let's say you establish the design heat load for a house is 88,500 BTU, so anything with an output over that (say 100,000 BTU or more) will do the job. And that's it.

So why do we constantly hear about houses where there are rooms that are always too cold, even though there's a large 200,000 BTU furnace in the basement? We recently heard of a case where the heating system was so poorly installed, the owners had put electric baseboards into two rooms that otherwise did not get enough heat. During renovations the errors in the distribution system were corrected - and suddenly those rooms had more than enough heat from the original furnace, so the owners gained use of an extra electrical circuit.

Heat loss calculations to establish the home's design load is only the starting point. Equipment sizing, distribution layout and control strategies also have to be designed properly. Using old rules of thumb and learning on the job alone is no longer good enough.

In B.C. the gas safety branch has issued a directive that requires a fully designed system for forced warm air heating systems. Industry associations have stepped in with training programs, offering a range of programs from introductory to advanced levels.

Hydronic systems, which are increasingly being used, also require knowledgeable design and installations. That is why the Residential Hot Water Heating Association of BC, a trade association of contractors, manufacturers and wholesalers of hydronic heating equipment has developed a design manual for hydronic systems. It is designed to supplement courses and course material offered by the Canadian Institute of Plumbing and Heating (CIPH).

Some in the engineering fraternity may consider this approach as lacking technical rigour and being overly simplistic. However, a simplified approach that is trades friendly has been verified by a rigorous technical analysis, and where simplifications are made, they are on the conservative side. This kind of approach offers a good starting point for more detailed future design courses.

A *Guide to the Design and Installation of Hot Water Heating Systems,* is a 110-page manual that takes you through the complete design procedure using simple, easy to follow worksheets (no computer needed - only a calculator to help out).

Heat Loss Calculations

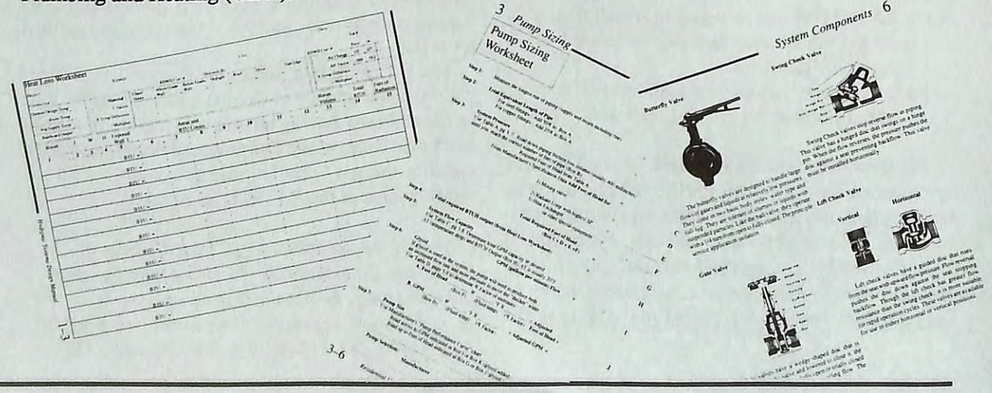
The heat loss worksheets provide a simplified square foot approach (based on the B.C. Building code standards) as well as more detailed room by room calculation worksheet based on construction type.

Radiant Floor Panel Design Layout

This work sheet lays out the procedures for the design of a hydronic radiant floor heating system. All necessary information is put on a single sheet, including additional information such as floor covering R-Values and a chart of floor surface temperature versus output.

Pump Sizing

The circulating pump is the heart of a water heating system. Flow rate required and pressure loss are key factors. The manual provides a description of how to read performance charts and a worksheet for sizing the right pump.



Expansion Tank Sizing

Expansion tanks are crucial to a hydronic system. Three alternative means of calculating appropriate tank size are offered.

Electrical Wiring Diagrams & Equipment Selection Information

Hydronic systems, unlike forced warm air, don't have all components packaged in a single neat box. Depending on the system layout, and number of zones, there are many possible combinations of components from a variety of sources. One section describes electrical components and wiring diagrams. Another section describes how key system components work.

Commissioning Checklist & Information

The best system will not perform if it is not commissioned properly as there are many items to check. A commissioning checklist containing 26 steps was prepared, along with an installation and service certificate, so that the installer could copy it and leave it with the purchaser, thus leaving proof of a complete job.

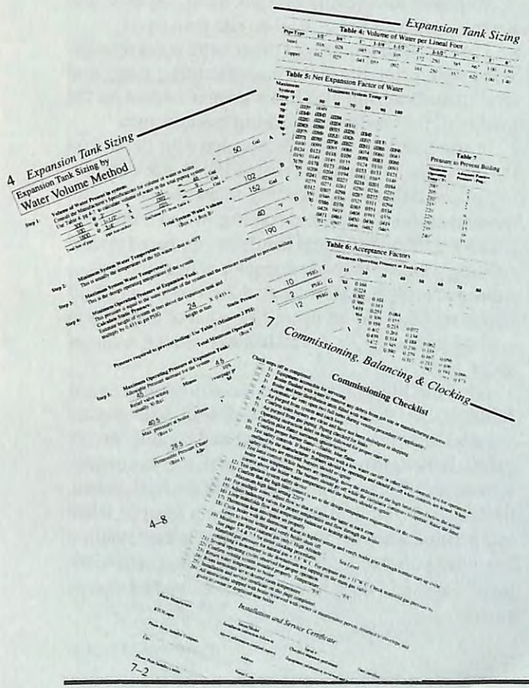
The manual contains all necessary charts, tables and formulas converted to Imperial measurements, explanatory text, diagrams & pictures, and a complete copy of the Hydronic Guidelines systems designs as well as filled in example worksheets. The 3 ring binder format is handy for inserting customized information on favourite products the installer uses. It will also be useful for builders who want to gain an understanding of how systems are sized and laid out.

The hydronic systems Design Manual will be valuable resource for heating contractors, and a worthwhile training tool for those entering the hydronic heating sector. The non member price is $75.00 (plus $7.50 postage/handling).

RHWH Association of BC
1860 Grant St
Vancouver, B.C. V5L 2Y8
Phone/Fax 604-251-2122

What about forced air heating? Another B.C. trade organization (the Heating Ventilation Cooling Institute of BC or HVCI) has developed a similar package for conventional forced air heating - that manual was put together in support of the Quality First program, a voluntary certification program that was started in Southern B.C. in conjunction with the gas utilities.

Information
Heating Ventilation Cooling Institute of B C
1860 Grant St
Vancouver, B.C. V5L 2Y8
Tel/Fax: 604-253-3000


Expansion Tank Sizing 4
Table 4: Volume of Water per Lineal Foot
Table 5: Net Expansion Factor of Water
4 Expansion Tank Sizing
Expansion Tank Sizing by Water Volume Method
Table 7
Pressure to Prevent Boiling
Table 6: Acceptance Factors
7 Commissioning, Balancing & Clocking
Commissioning Checklist
4-8
Installation and Service Certificate
7-2

EcoDesign Resource Centre on the Internet ... soon

An electronic database to promote and allow networking for design professionals and building trades is being created by the EcoDesign Resource Centre, a non-profit organization based in Vancouver. The focus will be on the impact the built environment has on the globe from a regional perspective.

The database will have 5 separate parts: building products; practitioners; projects; organizations; and a library catalogue. Target date for going online is the end of March 1996.

The project is being carried out with the financial assistance of the Canada-BC Agreement on Communications and Cultural Industries.

For additional information, or to obtain submission information:

EcoDesign Website Project, Fax 604-698-7016; e-mail: ecodesgn@freenet.vancouver.bc.ca

Wood and Steel Framing:
the Environmental Cost

All building materials are derived from natural resources but some require more processing than others to be useful. How we chose materials has both direct and indirect effects on the environment. Whoever specifies materials should be aware of some of the consequences. But how to do it?

for most products the major environmental impact is the embodied energy: the energy consumed in their manufacture, processing, and delivery.

For most products the major environmental impact arises from the consumed energy used in their manufacture, processing and delivery. That is why the most common yardstick is known as the embodied energy. The embodied energy is determined by evaluating the environmental effects of materials through a life-cycle analysis that evaluates the direct and indirect environmental burdens associated with a product, process, or activity. It quantifies the energy and material usage at each stage of a product's life cycle, from resource extraction to manufacturing through to construction, in service and post-use disposal.

The building sector accounts for a large part of total energy consumption - the Danish Building Research Institute estimates it to be about 50%. Energy consumption related to the entire construction process, including the production of building materials, right through to removal of buildings at the end of their useful life has to be added to operating consumption.

The Danish as many others around the world, are researching energy and environmental impacts of building design. They are trying to identify the energy consumption in all phases of the building's life cycle and to identify the impact on the environment in the form of SO_2 and CO_2 emissions to the atmosphere.

steel requires three times as much energy, and produces three times as much carbon dioxide as a comparable quantity of wood.

Forintek, the Canadian wood industry's research organization, has been heading a Canadian team developing a model to assess the environmental and economic sustainability of various building materials. This has been spurred on as wood is facing competition from other products, most notably steel, which claims to be more environmentally benign.

But what do we really know about the environmental impacts of building materials throughout their entire life cycle? Using the Forintek model to compare wood and steel framing on a typical wall section some interesting data emerges.

The comparison of wood and steel framing found that the environmental impact of manufacturing steel framing was much greater than manufacturing sawn lumber as steel is very energy intensive and produces high CO_2 emissions.

Steel requires three times as much energy as its wood counterpart to extract, manufacture, transport and construct. Carbon dioxide emissions, which contribute to global warming, are three times higher for steel than for a comparable quantity of wood.

While wood accounts for 46% of industrial raw materials (by weight) world wide, it uses only 4% of the energy required to process raw materials into useful products.

Air pollution emissions - such as sulphur dioxide, nitrous oxides, methane, particulate and volatile organic compounds - are significantly higher for steel. The solid waste generated during manufacturing and construction is 30 kg more for an equivalent wood wall section due to the more efficient use of steel on site than wood.

The steel wall requires 25 times more water than the wood wall, primarily at the manufacturing stage, and steel manufacturing also has a greater impact on the quality of the waste water during manufacture.

In-use building materials also have an impact on the environment, mainly because the choice of building materials will significantly affect the energy requirements for heating and cooling. Wood framing in a wall is a relative thermal insulator compared to steel framing which is a good conductor of heat and acts as a thermal bridge. A steel framed 2 x 4 wall with R-12 fibreglass batts has an overall R-value of only R-6 to 6.85 while a wood 2 x 4 wall has an overall R-value of about 10.9.

Over the life of a building these differences in R values mean that a steel-framed wall will require considerably more space heating and cooling energy unless the design incorporates adequate thermal breaks. If foam sheathing insulation is part of the wall system, the life-cycle implications of the foam must be taken into account when comparing the two wall assemblies. Extruded polystyrene is derived from non-renewable fossil fuels, and does have its own embodied energy contact.

(Continued on page 8)

Thermal Bridging Through Framing:
the performance penalty

Thermal bridging is a major concern with steel framing as it is a good conductor of heat. The high heat loss, and thermal gradients through the steel framing will have an impact on building performance, durability, and occupant health. An overstatement? We don't think so.

Wall Framing

We looked at a standard 2x4 frame wall (wood and steel stud framing) using the FRAME computer program. The basic wall construction assumed was a wall with brick veneer exterior, 1" air space, 1/2" OSB sheathing, R13 batt insulation. The steel stud wall was also simulated two ways: one with just the OSB sheathing (a not uncommon construction practice) and one with 1" polystyrene foam insulation (which also provides a thermal break).

Roof Framing

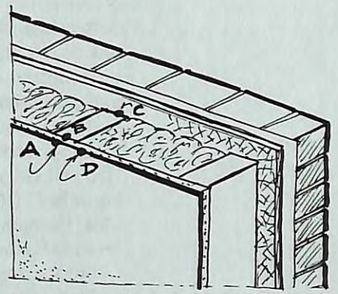
Steel suppliers show steel roof trusses when talking about all-steel houses. Unfortunately, putting a thermal break in a roof truss is not as easy to do as on a wall. We are still waiting for the steel industry to show us how they would suggest introducing a thermal bridge. The concern is that the truss webs directly connect the top and bottom chords (which are in contact with the interior ceiling).

Temperatures within the construction

(Exterior -18 C, Interior +21 C)

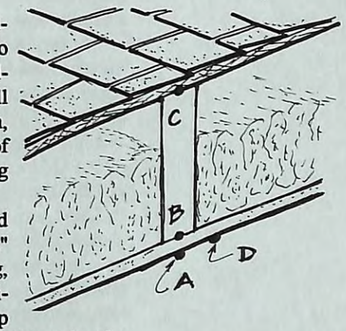
ROOF	Temperatures (C) at points noted on sketches			
	A	B	C	D
16" wood I; 1/2" OSB, 12" batt insulation	20.2	19.9	-17.4	-20.4
16" steel channel; 1/2" OSB, 12" batt insulation	14.5	12.3	-14.6	17.3
16" steel channel; sprayed in place polystyrene 1/2" OSB, 12" batt insulation	15.2	13.3	-11	18.5
WALL				
2x4 wood stud, 1/2" OSB, 3 1/2" batt	18.1	16.3	-8.3	18.9
2x4 steel stud, 1/2' OSB, 3 1/2" batt	14.2	10.1	0.8	17.2
2x4 steel stud, 1" polystyrene insulation, 3 1/2" batt	17.1	14.6	9.5	18.8

The only surefire way provide a break would be to place the insulation on top of the roof trusses, bringing the entire attic space inside the heated envelope - a practice that is never followed. The best we've seen is using plywood or OSB sheets on the roof as the base for the roofing, with the truss heel completely insulated with a spray in place foam insulation. This kind of construction detail is being monitored this winter in some steel framed houses north of Toronto.



Of course, an acceptable alternative would be to use conventional wood roof framing.

We simulated a vaulted roof condition using the FRAME software. To simplify the calculation, a vaulted ceiling was modelled rather than a full truss. This represents a simplification, but it still provides a good indication of the impact of the thermal bridging through roof framing.



The roof construction we simulated was a 16" deep wood I joist, with 12" batt insulation, gypsum board ceiling, 1/2" OSB sheathing and asphalt shingles. The steel roof assumed a 16" deep C channel, one calculation assumed 12" batt insulation only, the second assumed 2" of spray in-place polystyrene insulation encapsulating the channel right to the underside of the roof sheathing (what we would consider an optimistic case).

Plots of the temperature gradients and heat flow clearly show how the heat flow is affected by the steel. We also looked at the temperature at four points: (A) at the surface of the gypsum board, (B) on the inside surface of the framing member, (C) on the outside surface of the framing, and (D) on the inside surface of the drywall about ½" away from the framing. These are summarized in the table.

Temperature gradients are significant, as they show us where condensation may take place. Temperature gradients will contribute to ghost marks on the surface, which reflect dust accumulation. Studies in the 1970's for US Steel found that ghosting starts when surface temperatures vary more than 1.8°C - the greater the temperature difference, the greater the marking. ☼

Letters to the Editor

Re: Humidity Meters

Recently, there's been a lot of discussion about low-cost relative humidity indicators, so I thought your readers might be interested in a very low-cost indicator useful for consumer programs.

One of the questions we ask consumers complaining about moisture/condensation questions is "Do you know what the relative humidity in your home is ?" Of course, most people don't have any idea. Encouraging people to buy a $10 - $20 hygrometer at the hardware store isn't very successful.

Since we regularly send out our consumer bulletin Home Moisture Problems, I thought that enclosing an inexpensive RH indicator with the publication would be easy way to provide the consumer with an important piece of information they need.

The RH indicators we send out are colour-change indicator cards with a thermometer and they cost under a dollar. The manufacturer indicates they were developed for the military and are reasonably accurate - within 5% in the 8 - 80% RH range (technically it's 2.5% RH for each 10° away from 75° F) in other words at 55° F the device will be 5% off.

They're made by Humidial Corp, PO Box 610, Colton, CA 92324; (Tel: (714) 825-1793). They have a variety of styles but only sell the raw indicators with no company logo etc. Humidial's indicators mounted on switchplates etc. with company logos are widely sold by imprinted advertising specialty companies.

David Brook
Oregon State University
Extension Energy Program
Portland, OR

Re: Evolution of Building Materials

(Solplan Review, November 1995)

To the best of my knowledge no one is commercially producing electrochromic glazing as of now, nor plans to in the near future (5-10 years). The "new" windows use spectrally selective (low-E) coatings.

Keep up the good work.

Don Holte
Edmonton, AB

Re: The Energy Showcase Project

(Solplan Review, November 1995)

Thanks for the coverage of the Energy Showcase Project. Rest assured that the grass is not always "greener on the other side" and although we are doing our best with this unofficial effort, the UK does not yet have any official energy-efficient housing program on the Canadian scale.

In fact, we shall be making extensive use of Canadian technology, albeit adapted to suit UK conditions. The windows are just one example of this. We could not have done the underlying calculations without the help of FRAME and VISION programs.

So thanks to Canada. We're even considering plating a maple tree on the site, as a gesture of gratitude, and of course to absorb some CO2.

David Olivier,
Energy Advisory Associates,
Hereforshire, England

(Continued from page 6)

So is wood really better?

Wood is the only building material derived form a renewable resource. It is harvested and replanted in a continually regenerating cycle while non-renewable resources such as iron ore are mined on a depleting basis.

Although wood may appear to be a more environmental benign material, the issue is how well is the forest inventory managed? Are the resources sustainability managed? Unfortunately, the forest industry's history has not been good, in this regard although it is improving substantially. There may also be places where one or the other products is the better material to use.

But no matter what the numbers, it is still not that easy to generalize what the best material is. Much will depend, in the end, on the specific application. There are uses where steel is still the better option if used correctly.

The last stage of the life-cycle, post-use disposal, is difficult to assess because it takes place far in the future, and depends on the extent of product recycling programs in the location. ☼

Re: Odds 'n Ends

(Solplan Review, November 1995)

I was interested in the comments by Warren Jones concerning the Lennox Complete Heat System. We installed this system in a large house in late 1994. The system runs domestic water, 2 zones of in-floor heating, the forced air heating layout, a reheat coil for a Lennox 850 pool HRV, and a 30'x15' indoor pool, and (gasp) an indoor 5 person hot tub. The house is about 4,000sf with an almost full basement. All unremarkable except that the heating unit is only rated at 150,000 Btu.

The comment "...you can't turn off the fan ... because it also shuts off the domestic water function" indicates a controls problem external to the Complete Heat unit and not an

inherent fault with the system. The other problem of "...house overheating in the summer..." (did your comment on page 9 para 5 come from this anecdotal source?) due to fan motor innefficiency seems related to the controls problem (if the fan didn't have

to run all the time etc.) Has he REALLY been able to isolate the overheating down to the fan motor??? or is he just pissed off at the Lennox supplier (installer) for not being able to correct the controls problem? Has the supplier (installer) installed the necessary control valves to enable the system to operate properly?

Jim Marke,
Stuckey Construction
Red Deer, AB

This is not a question of being pissed off with the supplier. Charles Frass of Superior Gas Installation & Service, the installer of the system in question, confirms that in the Complete Heat system as set up the entire system is shut down to turn off the fan. The fan can be controlled independently by a wiring modification, but as supplied by the manufacturer, it does not have that feature.

Some of the overheating was definitely contributed by the motor. An efficient ECM motor running continuously is better than having to shut it off. As in many energy efficient homes, the furnace blower is kept running year round to distribute ventilation air and provide air filtration. This is especially critical in the shoulder periods of the year when there is little call for space heat but maximum mechanical ventilation need.

What has been highlighted is a good product with significant shortcomings. The manufacturer has been given an opportunity to make a significant improvement to their product to meet the needs of the customer. So far there hasn't been a response. Ed.

Re: Heat Pumps

(Solplan Review, November 1995)

I'd like to correct an error in the item on heat pumps. Outdoor air is used as the heat source to provide winter heating, not summer cooling. Indoor air is the heat source for summer cooling.

At below freezing there is still heat available in outdoor air, but it isn't enough to meet the heating needs. Also, as source temperature drops, so thes the COP. When the COP drops to 1.0, the heat pump is no more efficient than a resistamce heater.

George Pinch,
Vancouver, BC

We stand corrected. Ed.

Kudos

I find Solplan Review very interesting and informative. Your publication covers a wide range of topics and manages to keep my interest level sustained throughout.

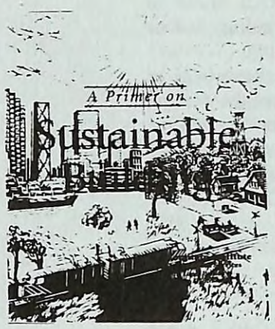
I work for a major Ontario gas utility, so I'm particularly interested in fuel cost comparisons. I'm also interested in how information is presented to the Consumer. The Consumer is constantly bombarded with "misinformation" and "out of context" information.

It's nice to see someone presenting the information as opposed to pitching it. You manage to present the material in a clear concise manner. (with a minimum of Advertising!)

Keep up the good work!

Neil Kelly
Consumers Gas
Mississauga, Ont.

A Primer On Sustainable Building



Sustainable design is not a new building style. Instead, it represents a revolution in how we think about, design, build and operate buildings. The primary goal of sustainable design is to lessen the harm poorly designed buildings cause by using the best of ancient building approaches in logical combination with the best of new technological advances. Its ultimate goal is to make possible offices, homes, even entire subdivisions, that are net producers of energy, food, clean water and air, beauty, and healthy human and biological communities.

Sustainable design is front-loaded. It's much easier to design for sustainability at the beginning, rather than trying to apply "good" technologies afterwards. The rewards come later. Design decisions and analysis should be based on a total life cycle analysis. Minimizing energy consumption is so central a goal that it should serve as an organizing principle.

Buildings shouldn't be thought of as disposable products. Instead of the customary 30 year design life (which, after all, is only about 11,000 days), why not aim for a century or more?

There may be a lot of interest in pursing the sustainable approach, but how to make the right decisions? The Rocky Mountain Institute, an non-profit research and educational foundation that fosters the efficient and sustainable use of resources, has published an interesting primer that helps to answer this question. Principles are clearly stated, and many examples of real projects help to bring this to life. They show how designers and builders are already putting many principles into practice.

This is an excellent tool for everyone in the construction and development industry.

What makes a building sustainable?

- it makes appropriate use of land
- it uses water, energy, lumber and other resources efficiently
- it enhances human health
- it strengthens local economies and communities
- it conserves plants, animals, endangered species and natural habitats.
- it protects agricultural, cultural, and archaeological resources
- it is a nice to live in
- it is economical to build and operate.

A Primer on Sustainable Building by Rocky Mountain Institute (Dianna Lopez Barnett & William D Browning). U.S. $16.95 Rocky Mountain Institute, Snowmass CO.
Tel: 970-929-3851 Fax: 970-927-4178

Flex-Housing Design Competition

There's a new perspective coming to the housing market. A changing population is demanding features designed to adapt a wide range of needs. This includes singles, couples and families from all ages and walks of life; safety and comfort-conscious adults; younger people with disabilities, and older people looking for long-term retirement housing solutions.

Homes with special features to help people stay independent and active can be attractive to a wide spectrum of buyers. They also accommodate changing lifestyles, including home-based work. Builders and developers can enhance the appeal of their products to this market with modest, cost-effective design enhancements.

The flex-housing design competition is CMHC's response to these coming changes. This competition will select designs in three housing categories -single-detached, horizontal multiples, and low-rise apartments - for each of Canada's five regions. A total of 15 winning designs will be selected, each of the winners will be invited to proceed to Stage 2 and will receive $5000 to offset costs of further design development. Entries for Stage 1 must be submitted by May 31, 1996.

Applicants must be developers, builders or groups that intend to build the designs they submit.

Contact your nearest CMHC office or the Canadian Housing information Centre for competition information. For more information:
Canadian Housing information Centre
Tel: (613) 748-2367 Fax: (613) 748-4069

A Sustainable Energy Future:
How do we get there from here?

A Conference sponsored by the
SOLAR ENERGY SOCIETY OF CANADA INC

June 9 - June 12, 1996
FERN RESORT, Orillia, Ontario

SESCI '96 promises to be the most important Canadian energy and environment conference of the year. Speakers from across Canada, the United States, and Europe will attempt to define "here" and "there," and the technical and commercial strategies needed to get there from here. SESCI '96 has all the ingredients needed for a successful conference: a beautiful location, a variety-filled program, and superb speakers.

The Location

The Conference will be held at the Fern Resort on beautiful Lake Couchiching. The Fern's secluded setting will promote a focussed conference and active dialogue. Extensive social and recreational facilities will make this year's SESCI conference more fun than ever. Bring the family and make SESCI '96 a part of your holiday planning.

The Program

The program is filled with variety! Our major event will take place following the conference dinner, when a joint presentation by two informative and entertaining speakers will describe the principles underlaying sustainable development. This thought-provoking presentation will be followed by an evening of focus group discussion. Two days of technical presentations will cover a wide range of topics, from the latest academic research to economic strategies in a changing marketplace. This year's conference will include two panels, one on technical advancements, and one on successful marketing strategies. The final day of the conference will wrap up with a session devoted to innovative uses of solar energy.

SESCI '96 includes an active student program. Post-secondary students will present their research during a student forum and poster session. High school students with winning entries in the Great Canadian Solar Race will proudly demonstrate their solar cars.

IMMEDIATE ATTENTION REQUIRED — IMPORTANT DATES
February 29 - Final Date for receipt of paper abstracts (200 to 300 words)
March 15 - Final Date for guaranteed registration at the Fern Resort
April 1 - Final Date for early conference registration

The Invited Speakers

DAVID EWING (Americus, Georgia) is the Vice President of Habitat for Humanity International, the fifth largest home builder in the world. Habitat is working on incorporating environmental responsibility and energy efficiency in its housing program.

CAMERON SMITH (Lansdowne, Ontario) is former Managing Editor of the *Globe and Mail* newspaper. He writes a column on sustainable development for the *Toronto Star*, and is currently writing a book on the same topic.

STEVEN STRONG (Harvard, Massachusetts) designs PV-powered homes and was responsible for the world's first solar-powered neighbourhood. Mr. Strong has also developed a PV-module that generates AC power, and is author of *The Solar Electric House*.

JOHN L. KNOTT, JR. (Isle of Palms, South Carolina) is the developer of Dewees Island, South Carolina, the first holistically-planned, sustainable community in the United States.

OLIVER DRERUP (Ottawa, Ontario) is well-known as Canada's expert in the field of environmentally responsible house construction and healthy housing.

PATRICK CARSON (Toronto, Ontario) is Vice President, Environmental Affairs, for the Loblaw Group of Companies. Mr. Carson is a member of the Prime Minister's Roundtable on Energy and Sustainable Development.

MICHAEL MARGOLICK (Vancouver, British Columbia) is a utility planning and economic consultant specializing in resource and environmental economics. He was Executive Director of the BC Energy Council and the principal author of *Sustainable Energy Strategy*.

Technologies for the Future

Tuesday afternoon will feature a panel on the latest technical developments in energy efficiency and sustainable technologies. **Tim Mayo** of Natural Resources Canada will highlight the winning technologies from the Advanced Houses Program, **Stephen Carpenter** of Enermodal Engineering will present the technologies used in Canada's first C-2000 office building, and a representative from **Oak Ridge National Laboratory,** Tennessee, will describe their building research program.

Selling Sustainability

The second panel on Tuesday will focus on marketing green technologies. Panelists include **Teun Bokhoven,** the leading manufacturer of solar domestic hot water systems in the Netherlands; **Doug George** of Dover, New Hampshire, a builder of energy- and resource-efficient homes; **Colin Isaacs,** former Executive Director of Pollution Probe and a consultant on the greening of business; and **Brian Kelly,** Director of the Environment and Sustainable Development Division of Ontario Hydro.

What's New Under the Sun

Wednesday morning's session will be on the latest use of solar energy: cleaning up the environment. **Michael Dixon** of the University of Guelph will present the "Living Wall," a system that purifies indoor air, **Doug Lorriman** of Solarchem Environmental Systems will describe the use of solar energy in the detoxification of hazardous waste, and **Greg Allen** of Allen Associates will discuss "Living Machines"—solar-based systems that treat waste in water and soil.

Itinerary

	Saturday, June 8	Sunday, June 9	Monday, June 10	Tuesday, June 11	Wednesday, June 12
MORNING	**CANSIA WORKSHOPS**	**CANSIA WORKSHOPS**	**Defining "here"-- the current state of renewables** Steven Strong: *World Tour of Building Integrated PV* Cameron Smith: *Sustainable Development in Canada* Technical Papers	**Defining how we get there from here** Michael Margolick: *Energy Sustainability & the Planning of Cities and Towns* Patrick Carson: *Sustainable Development --is it an Oxymoron?* Technical Papers	**Putting It all together** Technical Papers **What's New Under the Sun** **Conference Summary**
AFTERNOON		Welcome Reception and Great Canadian Solar Race	Lunch Technical Papers University Student Forum & Poster Session	Lunch Technical Papers **Panel on Technologies for the Future** **Panel on Selling Sustainability** Technical Papers	**Lunch and Closing Address**
EVENING		**BBQ and Opening Address** with David Ewing, Habitat for Humanity	**Defining "there" Conference Dinner** with John L. Knott Jr. and Oliver Drerup: *The Sanborn Principles of Social and Environmental Sustainability* (joint presentation and focus group discussion)	Dinner **Awards Night** (2- hour cruise on Lake Couchiching)	

CANSIA, the Canadian Solar Industries Association, will be running workshops June 8th and June 9th. Further details can be obtained from the CANSIA office, 2415 Holly Lane, Suite 250, Ottawa, Ontario, K1V 7P2.
Tel: (613) 523-0974 • Fax: (613) 736-8938 • Email: solar@worldlink.ca

SESCI '96

A SUSTAINABLE ENERGY FUTURE: *How Do We Get There From Here?*

June 9 - June 12, 1996 Fern Resort, Orillia, Ontario

(Name on badge) _____ (Affiliation or company name on badge) _____

(Full Address) _____

(FAX/E-mail) _____ (Daytime Phone) _____

(Spouse name if spouse is attending social functions) _____

SESCI '96 is a complete 3-day package of conference and social activities, and the registration fees reflect this. We encourage you to stay at the FERN RESORT in order to participate in the full program. Attendees who are not staying at the FERN will pay an off-site surcharge to cover the cost of two meals a day, meetings rooms, coffee breaks. Please ensure that you make two payments, one to SESCI for conference registration, and one to the Fern Resort for accommodations and meals.

REGISTRATION FEES

(remit to SESCI)
(does not include accommodation)

	Before April 1	After April 1
Member	$265	$340
Non-member	$340	$415
Student	$115	$165

SESCI Registration Fee $ _____

Off-Site Surcharge($177) $ _____
(see paragraph above)

SUB-TOTAL $ _____

GST 7% of sub-total $ _____

TOTAL $ _____

Refunds: refunds given up to May 15, subject to $25 non-refundable administration fee

Method of Payment: ☐ Cheque ☐ VISA ☐ MC

Please make cheque payable to SESCI Conference '96
250-2415 Holly Lane, Ottawa, ON K1V 7P2
TEL (613) 523-0974 FAX (613) 736-8938
EMAIL: solar@worldlink.ca

_____
(Card Number / Expiry Date)

_____
(Signature)

ACCOMMODATION

(remit to FERN by March 15 to guarantee registration)

Rates include 3 meals daily and full use of all facilities: indoor and outdoor pools, fitness centre, playground, tennis courts, 5-hole golf course.

RATES PER PERSON PER DAY	
Single Occupancy	$150
Double Occupancy	$115
Triple Occupancy	$105
Quad Occupancy	$ 95

(PST, GST, services charges extra)

Date of Arrival _____

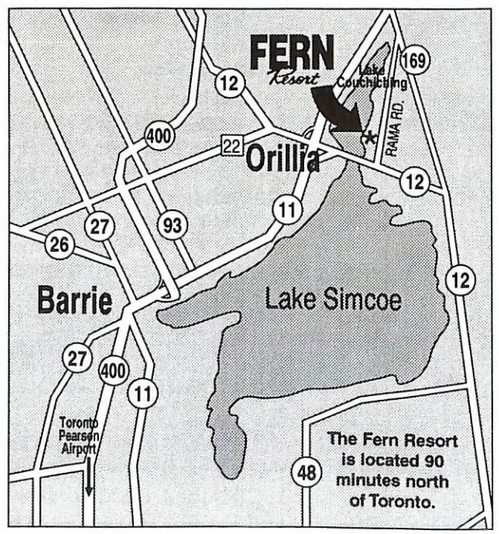
Date of Departure _____

Method of Payment: ☐ Cheque ☐ VISA ☐ MC

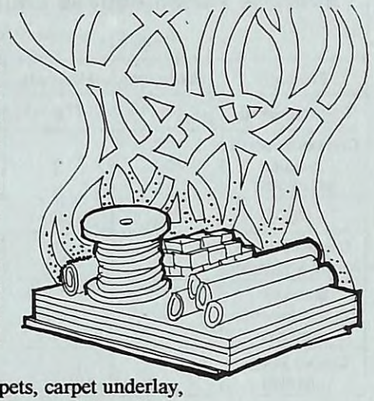
Please mail cheque to: **THE FERN RESORT**
RR 5, Orillia, ON L3V 6H5 Tel (705) 325-2256 / Fax (705) 327-5647

_____
(Card Number / Expiry Date)

_____
(Signature)



Building Materials Chemical Emissions



Products used in buildings can contribute pollutants that, in high concentrations, can be damaging to occupants. This is one cause for sick buildings and also a major reason why the R-2000 program has introduced requirements for indoor finishing materials.

We don't yet have guidelines for acceptable levels of indoor pollutants for many commonly found compounds. The lack of data on indoor air pollutant sources leads to confusion as existing building regulations and health guidelines are sometimes contradictory. The issue is complicated by the fact that many polluting sources may not be building materials, but household furnishings, occupant artifacts, and lifestyles.

The National Building Code of Canada and CSA Z240-Mobile Homes Standard attempt to deal with pollutant concentrations by ventilation. However, the ventilation capacity requirements for residences are not related to the strength of the indoor air pollutant sources. Similarly, CSA F326 specifies room by room ventilation requirements, independent of pollutant sources.

The problem for anyone trying to select and specify "good" products is where to start. Manufacturers don't, as a rule, identify how good (or bad) their product may be. Even when they have, or provide, information it is often incomprehensible to all but a few chemists! *(See Solplan Review No. 63: Reading an MSDS).*

In the future, more information will become available as more test data is gathered. The National Research Council now has a facility to test the materials emissions of various products, and is carrying on tests as part of an international effort. The objective is to gather data on the emission characteristics that can be expected in newer homes and to provide information for use in computer simulations. These will be able to predict the indoor air quality based on source emission and house ventilation characteristics when known quantities of products are used.

The Saskatchewan Research Council recently tested the Volatile Organic Compound (VOC) emissions for a variety of materials used in the Advanced Houses and from a group of Halifax area R-2000 houses. Materials from the Advanced Houses were representative of currently available materials and had been "aged" for a period of six to eighteen months before being tested. The materials from the Halifax R-2000 houses were new, un-aged materials that should be representative of the emission properties of products installed in typical new homes.

Each sample within a product type was tested in a standardized way. The tests were developed keeping in mind how the product is used in a building so assumptions were made about product preparation, aging and product loading.

Products tested included carpets, carpet underlay, vinyl flooring, engineered wood materials, cellular plastic insulation, gypsum board and latex paint. Each of these classes of materials (and individual product samples within the class) would have a unique product history. In total, 37 materials were tested for VOC emissions and 20 materials were tested for formalde-

Table 1

Total Volatile Organic Compounds Emissions (TVOC)
(ug.m2-h)

Product	Maximum	Minimum	Average
Carpet	56,223	18	14,896
Vinyl Floor	9,408	948	3,425
Particleboard			114
Composite wood product assemblies	1,378	459	737
Low emission paint	42	9	26
Conventional paint	308	243	276
Foam insulation	68	45	57
Structural composite wood products	386	55	228
Carpet underlay	856	33	445
MDF	835	57	340

Table 2

Average Formaldehyde Emissions (ug/m2-h)			
Product	Maximum	Minimum	Average
Particleboadrd	7	6	7
Composite wood product assemblies	639	3	297
MDF	365	42	235
General interior finishing materials	<9	<6	<8
Structural composite wood products	84	<5	22
Coated interior plywood			655

hyde emissions. Table 1 summarizes total VOC emission levels, and Table 2 summarizes average formaldehyde emission levels.

Sheet goods (e.g. flooring, subfloor) that are cut and installed in place typically may be obtained from a supplier's inventory that could have been in storage for months or even years depending on the supplier turnover so some product aging (and offgassing) may take place in the suppliers warehouse. Many of these materials have emission characteristics which change relatively slowly with time.

Another category of materials are those produced by components which don't age and change until they are installed (e.g. paints, spray-in-place insulation). Many of these "wet" application materials have a very quick change in initial emission characteristics.

Materials from the Advanced Houses were exposed to various conditions before purchase and on the job site. The samples from the Halifax R-2000 houses were typical products used in new houses, but the samples were fresh, taken at the time of construction or from an identical product inventory at the suppliers.

Results indicated an extremely wide range of emissions within a material type. For instance, the total volatile organic chemical emissions of the carpet samples varied from a low 19 to a high of 56,000 (ug/m² . h). For most other products the range of emissions was lower but still typically one to two orders of magnitude. The tests indicated that while some specific materials could be a problem, the total emission source in new houses is distributed among a variety of commonly used construction materials.

Analysis of the emissions from the two carpet samples with high emissions suggested they may have originated from cleaning solvents and other petroleum-based products. The wide variation in emissions raises two questions:

(1) is the range of emissions typical of currently available products; and

(2) did the product samples become contaminated as a result of off-site or on-site handling?

Currently, the Carpet and Rug Institute (CRI) has established voluntary emission requirements for labelling of carpet products. Of the carpets tested, four met the CRI guidelines for TVOC and all easily met the other chemical compound emission criteria.

However, some products can absorb contaminants from the environment through which the material passes, so even a "clean" low emissions product can become contaminated once it leaves the manufacturer. Carpets and drywall can absorb chemicals from their environment during the construction process and thus act as significant secondary emission sources of pollutants. If carpets are delivered on-site with relatively low emission factors but during the construction process they become contaminated and act as secondary sources, the construction process may require significant changes to prevent this contamination from occurring. This is an extremely important issue as it may affect traditional work practice and construction scheduling as well as the overall indoor air quality performance of new housing.

Carpet underlay is another product of concern. A relatively clean carpet placed over an underlay with a high TVOC emission factor, will become contaminated.

The TVOC emission factors for spray-in-place polyurethane foam insulation materials were relatively low which is typical for aged insulating materials of this type. Most of the emissions take place in the first few days of foaming and are typically reduced to very low levels within thirty days.

Table 3 Scandinavian Guidelines

Maximum TVOC Emissions	ug/m2-h
Low emission material	less than 40
Medium emission material	40 to 100
High emission material	over 100

Is there a lesson to be learned? In most buildings significant indoor air quality improvements will not be achieved by picking out individual products as "problem" materials, but rather through a careful and planned assessment of all of the potential components of the building.

The Scandinavian Countries have produced TVOC emission guidelines based on the amount of ventilation required to achieve a certain IAQ classification. These are summarized in table 3.

Most of the building materials tested by the Saskatchewan Research Council had some products which would currently meet the Nordic low or medium emission criteria. However, the vinyl flooring and manufactured wood products classifications did not identify any products which would meet the low or medium emission criteria. ☼

Reducing formaldehyde emissions

Eliminating the pollution source is the best means to avoid indoor air quality problems. Formaldehyde emitted from composite wood products is of concern as there is a wide variation in the formaldehyde emission characteristics from the materials available to builders. Indoor formaldehyde levels can easily exceed the health guidelines action levels by a factor of three or more especially in small dwellings even though building code ventilation requirements are satisfied. Panel board manufacturers are beginning to address the issue, but many of these products are still major pollutant sources.

Sealing of particle board has been suggested as a solution to reduce formaldehyde emissions. But how effective is it?

Laboratory tests at Saskatchewan Research Council measured the formaldehyde emissions from pressed wood products samples when they were sealed using a variety of coatings. The samples included particleboard and medium density fibreboard sheets with and without factory applied surface finishes.

Samples were placed in chambers at 23° C and 50% relative humidity for seven days before testing. An air flow rate of 0.5 air changes per hour (ACH) was maintained during the test. The tests showed a wide variation in the formaldehyde concentrations and emission rates.

The tests showed that formaldehyde emissions can be reduced drastically by sealing all exposed edges. Emission reduction due to paints tested are noted in table 1. (Paint formulations may change from time to time).

As will be noted, some paints performed better than others. It is important to note that some paints are more effective at sealing the particleboard than others. Most important, it is necessary to remember that all surfaces must be sealed. This means that if a hole is cut, the cut edges have to be sealed too. For example, if cut in a cabinet is made for a sink or piping, the cut edges have to be sealed. ☼

REDUCTION IN FORMALDEHYDE EMMISIONS		
PAINT	TYPE	REDUCTION
Moorcraft 256-00	alkyd primer sealer	100%
KILZ	alkyd primer sealer	91%
Northern Paints Color Lox	oil enamel undercoat	97%
INSL-LAC	alcohol base primer sealer	90%
Benjamin Moore Impervo	alkyd enamel	100%
Aqualock	water based primer sealer	37%
Insul-Aid	latex vapour barrier paint	38%

For further information on the R-2000 Program, contact your local program office, or call 1-800-387-2000

Technical Research Committee News

Canadian Home Builders' Association

CMHC Builders Series publications

Questions are raised regularly about the need for research to deal with specific problems that arise. A review of the problem often uncovers that the necessary information is already out there but builders and designers don't know about it!

Many of the most common construction problems were identified and compiled in a Builder's Series of booklets published by CMHC a few years ago. . Every builder should have a copy of the series to refer to. Unfortunately, they're not being marketed as well the should be. For a list available publications, contact your local CMHC office or the Canadian Housing Information Centre at 1-613-748-2367

Ice damming

Roof construction detailing in use today has generally resolved ice damming problems. These typically occur at the eave line, where there maybe more heat loss, creating a warm spot on the roof, causing snow on the roof to melt, and freeze again on the overhang (which is cold).

Typically ice damming problems are issues that occur in older, poorly insulated buildings. Recent changes to codes and construction practices seem to suggest that it should not be a problem in new construction.

However, there have been recent reports of ice damming problems in new Ontario homes. Suggestions have been made that there may be conflicts between code requirements and performance goals. We would like to hear from builders that have encountered these problems. Let us know the nature of the problem you've encountered, and the kinds of remedial action that has been taken. Comments can be forwarded to the TRC.

Envirohome

The Envirohome combines R-2000 technical standards with healthy home features. This marketing demonstration program is continuing into 1996, new proposals are welcome. The official '96 kick-off will take place at the CHBA convention in Vancouver.

Currently, there are 5 houses in the program for 1996, most carry-overs from last year (construction was delayed due to slow real estate markets in some areas).

Public response to the Envirohomes has been very positive, and the houses are getting good reviews. Anyone wanting more information should contact John Broniek at CHBA in Ottawa.

Wall Moisture Problems

Moisture penetration through exterior sidings is always a concern. Stucco finishes present a special challenge. Exterior Insulated and Finish systems (EIFS) are a related type of cladding material that has been a source of considerable problems.

The nature of the material is such that moisture penetrating the foam insulation accumulates behind it, thus leading to moisture deterioration.

Many of the problems are due to poor installation details. The new High Rise Residential Construction Guide (by the Ontario New Home Warranty Program) offers some solution, including suggested EIFS rain screen details.

The Technical Research Committee (TRC) is the industry's forum for the exchange of information on research and development in the housing sector. If you have any problems, technical questions, or suggestions for areas that need to be investigated, you are encouraged to contact your local Home Builders' Association technical committee or the TRC directly at:

Canadian Home Builders' Association, Suite 200, 150 Laurier Ave. West, Ottawa, Ont. K1P 5J4
Tel: (613) 230-3060
Fax: (613) 232-8214

Defective Oriented Strandboard (OSB)

OSB and plywood, as any organic building material, are vulnerable to moisture problems. Recent problems with engineered wood products has raised questions about the durability of OSB. On the west coast there has been deterioration of OSB sheathing beneath stucco. In the U.S., there has been failure of composite board siding produced by Louisiana Pacific.

There are differences between the two products and the problems associated with each.

Oriented Strandboard

Oriented strand board structural wood sheathing panels have been in use in construction since the late 1970's. Like plywood, OSB panels use waterproof phenolic or a combination of phenolic/isocyanate resin binders. While plywood uses wood veneer sheets, OSB uses small wood wafers, which are oriented into layers to form panels.

OSB is identified and accepted for use as structural sheathing by all U.S. and Canadian building codes providing it is manufactured in accordance with CSA Standards (CSA O437 OSB and Waferboard and/or CSA O325 Construction Sheathing.) or U.S. Standard PS2-92 Performance Standard for wood based structural panel.

Many OSB manufacturers provide a Certificate guaranteeing their products provided the panels are installed in accordance with the manufacturer's instructions. Installation instructions are also available from the OSB manufacturers associations.

Neither the Structural Board Association nor APA-The Engineered Wood Association or the other agencies involved are aware of any failures with the use of any OSB sheathing when properly installed.

Panel failures recently seen on the west coast are associated with stucco finishes. Water is getting in behind the stucco due to inadequate care and attention to details during the installation of the stucco. Too often the building paper used is inadequate and is applied backwards so that the water is driven into the wall where it doesn't have an chance to run off and dry out. Flashing details have often been found inadequate for their environment. So much water is getting behind the stucco, over time, that there is often a failure of the building paper, that the water sits directly against the wood fibres with little opportunity to dry out. The wood fibres in a panel that remains wet begin to absorb the moisture and swell. Over time this can stress the bonds between the glues and wood, leading to a deterioration of the panel.

Treating OSB will not resolve the problem created by poor siding application, as has been suggested by some. The same problem has not been observed with plywood but that may be because plywood sheathing has not been used much in recent years. Fir plywood will be a bit more resistant to the moisture deterioration - but only for a period of time. Given the right conditions plywood will also delaminate - it just may take a few more months.

OSB siding failures

In the minds of some, structural OSB sheathing panels are being lumped together with the problems encountered in the U.S. with the Louisiana Pacific Corporation's composite wood siding product. This is a siding board that has a smooth or embossed surface, usually a paper overlay, applied to the exterior surface of a waferboard.

The main concern has been that the drip edge on the lap siding can act as a wick, drawing moisture up into the OSB substrate causing it to heavily discolour and the fibres to swell along the drip edge or under the paper causing it to bubble.

Apparently, a major contributing factor was that the product was tested to meet structural test standards, where it's performance was satisfactory, but there was inadequate exposure testing, to see how it performs when exposed to the elements.

Other failures happened when the siding was not properly flashed, such as at inside corners, or on a north facing building wall, where it became saturated with moisture from different sources and did not have a chance to dry out after getting wet. Many of the problems happened in coastal areas where wind blown horizontal rain is common. Like all primed wood siding products, good construction and painting practices using a recommended paint system are essential.

Another contributing factor is that the US composite board siding is sold unfinished (at best it is pre-primed), so that performance is at the mercy of the final installation. If attention to flashing details, painting and finishing is not done, there will be problems. Or, as so often may happen, the siding is installed some time before the finishing work is done, so the unfinished product is exposed to the elements for some time.

Fortunately for Canadian builders, the product was not sold in Canada except to a few manufactured housing companies in Alberta.☼

Health benefits of good housing

A healthy home environment is important to good health. This includes improved indoor air quality which can be achieved, in part, by careful selection of indoor finishing materials and good ventilation.

R-2000 technical requirements now require careful materials selection and CMHC has launched the healthy house initiative. But sceptics still say "prove it to me that these steps will provide a healthier environment". Just what is the evidence that a house built to R-2000 or "healthy house" guidelines is healthier?

Monitoring the health of individuals living in houses is not an easy task as there are many variables. There is little scientific data, but some studies looking at the health of R-2000 residents are underway. In the meantime, we have lots of anecdotal information from R-2000 homeowners who've noted improved health and a reduced need for drugs and medical treatment after having moved into their new home.

Visitors to new R-2000 and healthy homes have noted the lack of the typical "new house smell" (which is really the off-gassing of VOC's from new, mainly synthetic, building products). Chemically hypersensitive individuals have noted an improvement in their situation when they can retreat to a clean environment, where many commonly used materials have been avoided.

A social planning study for the Vancouver Planning Department looked at conditions in a run down section of downtown. It provides interesting insights how the home environment can affect health. The area is home to a large number of mostly low income residents. Some live in run down rooming houses, others in newer social housing units, and a few in new market condominium apartments. The overall health status is much worse than for the Canadian population.

The study found residents of the social housing units, even though they are older and have poorer health than those living in the rooming houses, use fewer emergency services and end up in the hospital less often than the rooming house residents. When they do end up in the hospital they stay there for fewer days. Part of the explanation may be that social housing residents take advantage of preventive services more often, but more likely it is accounted for by the better quality home environment.

The authors of the study were surprised with this finding, noting that "good housing affects other aspects of well-being, and safe, secure and affordable housing can be seen as a viable preventive health measure"

This study looked at a poor population group that is on the margin, highly at risk. However, it is one of the few studies we've heard about that has recognized a direct link between the quality of the home environment and resident health. ☼

Global Warming

In the middle of a Canadian winter it may seem odd to be talking about global warming. But the evidence shows that the earth is in fact getting warmer - 1995 was the warmest year ever with an average temperature about 0.41° C above long term averages. In fact the 10 warmest years in the last 140 years (since accurate measurements have been documented) have happened in the last 14 years.

We still have a way to go before we curb this trend. One of the most important steps is to reduce the quantity of greenhouse gases into the atmosphere. In the United States alone total human caused Greenhouse gas emissions have increased by 27 million metric tons between 1990 and 1993 according to the Energy Information Administration. The total excludes the carbon removed from the atmosphere by forests.

Preliminary data for 1994 show carbon dioxide emissions in the 1990's growing at an annual average rate of 1% - slower than that for the economy as a whole. Canadian figures will not be substantially different.

Carbon dioxide is the major greenhouse gas with about 85% of total global warming potential. Methane emissions decreased 5% between 1990 and 1993, but emissions of nitrous oxide, which has a warming potential greater than either carbon dioxide or methane, have grown during the 1990's. Emissions of HFC's including several ozone-safe replacements for chlorofluorocarbons (CFC's) have increased by more than 20%.

So what does this have to do with builders? Buildings account for about 1/3 of total energy consumption in Canada. In most cases this means combustion of natural gas, oil, or coal either directly for space heating or for thermal electric generation. If we are to have an impact, to fight these environmental changes, we have to be more aggressive in reducing energy consumption through energy conservation and optimizing use of renewable energy sources. ☼

Index to Issues No. 51 - 65

This index will make it easier for readers to find items that appeared in past issues of Solplan Review. An index to earlier issues appeared in Solplan Review No. 50 (May 1993).

1995 National Building Code, May 1995 No. 62
A Vent Failures, Apr-May 1994 No. 56
Advanced Houses Attract Attention Aug-Sept 1993 No. 52
Advisory Committee on Materials emissions, March 1995 No. 61
Air Sealing Handbook Oct-Nov 1994 No. 59
Air-Barrier performance guidelines, January 1995 No. 60
Air Barrier System Details For Houses June-July 1994 No. 57
Airtight Plumbing Seal May 1995 No. 62
Airtightness Testing of market housing, Apr-May 1994 No. 56
Alberta Sustainable House March 1995 No. 61
Allergy Is it the New Epidemic? May 1995 No. 62
Are There Differences in Fire Safety Between New and Existing Buildings? January 1995 No. 60
Attic Ventilation Aug-Sept 1993 No. 52
Autonomous House Award (1995) - Alberta Sustainable House; Nov 1995 No. 65
Baseclad: Use it or loose it. Feb-March 1994 No. 55
Basement wall framing May 1995 No. 62
Basement Performance Study; Nov 1995 No. 65
Basement Research Project, Oct-Nov 1994 No. 59
Basement wetting problems Dec-Jan-1994 No. 54
Basement Research Project; Aug-Sept 1994 No. 58
Basement Insulation Alternative Aug-Sept 1993 No. 52
Brampton Advanced House Performance June-July 1993 No. 51
Build Green Label Launched Oct-Nov 1994 No. 59
Builders' Environmental Check List Oct-Nov 1993 No. 53
Building Green: Build Green Label Program Oct-Nov 1993 No. 53
Building Healthy Homes:: A House For The Environmentally Hypersensitive May 1995 No. 62
Building with Value: Resource Efficient Construction Dec-Jan-1994 No. 54
Building Papers Nov 1995 No. 65
Canadian Renewable Energy Guide (book review); Nov 1995 No. 65
Canadian Technology Network, Sept 1995 No. 64
Carpet Staining, Apr-May 1994 No. 56
Carpet Labelling Aug-Sept 1994 No. 58
Carpets and Indoor Air Quality Dec-Jan-1994 No. 54
CCMC Registry of Product Evaluations Dec-Jan-1994 No. 54
CCMC Referenced in Ontario Building Code June-July 1993 No. 51
CHBA Position Paper on the Scope of Building Regulations, June-July 1994 No. 57
CHBA Builder Manual Feb-March 1994 No. 55
Checklist For Preventing Foundation Problems Feb-March 1994 No. 55
Chimney Venting Failure, Oct-Nov 1994 No. 59
Code and Construction Guide for Housing June-July 1994 No. 57
Combination Heating System Oct-Nov 1994 No. 59
Combo Space and Water Heating Systems Aug-Sept 1994 No. 58
Combustion Vent Clearance July 1995 No. 63
Compact Fluorescent Lighting Directory March 1995 No. 61
Composting Toilets Apr-May 1994 No. 56
Composting Toilets and Greywater systems Oct-Nov 1993 No. 53
Concrete Housing Handbook (book review) March 1995 No. 61
Contaminated Lands Feb-March 1994 No. 55
Cost/Benefits of R-2000 June-July 1994 No. 57
Defect Prevention June-July 1994 No. 57
Did You really shut it off? Nov 1995 No. 65
Doors as Sound Barriers July 1995 No. 63
Dry Air - how dry can it get? Dec-Jan-1994 No. 54
Dry Lumber - the Importance of; June-July 1994 No. 57
Drywall Solutions:Avoiding cracking problems Dec-Jan-1994 No. 54
Drywall staining Oct-Nov 1993 No. 53
Duct Cleaning: is it worth it? Aug-Sept 1994 No. 58
E-House Indoor Air Quality Product GuideTM July 1995 No. 63
e-mail: how it works Sept 1995 No. 64
EASE Air Sealing Approach Sept 1995 No. 64
Eco Design Resource Centre May 1995 No. 62
Ecological Footprint (How Big is our)? June-July 1994 No. 57
Ecologo Expands to Building Materials Sept 1995 No. 64
Efficient Lighting Aug-Sept 1994 No. 58
Efficient Residential Exhaust Ventilation, a more effective way March 1995 No. 61
Efficient Residential Exhaust Ventilation January 1995 No. 60
Electric Radiant Heating Systems Equipment Disconnect Order January 1995 No. 60
Electric Ceiling radiant systems, June-July 1994 No. 57
Electronic Line Voltage Thermostat Dec-Jan-1994 No. 54
Electronic Access Building Products Directories January 1995 No. 60
Emissions and the Ecologo Label Aug-Sept 1994 No. 58
Energy Codes Oct-Nov 1993 No. 53
Energy Showcase Project; Nov 1995 No. 65
Engineered wood product installation practices, July 1995 No. 63
EnviroHome March 1995 No. 61
EnviroHome Oct-Nov 1994 No. 59
Envirohome, July 1995 No. 63
Envirohome update, January 1995 No. 60
EnviroHome: The CHBA-Canada Trust Environmental Homes Initiative Apr-May 1994 No. 56
Environmental products guide Dec-Jan-1994 No. 54
Environmental by Design: a Source book Aug-Sept 1993 No. 52
Environmental Choices for Homebuilders and Renovators Apr-May 1994 No. 56
Environmentally Friendly Products Directory Aug-Sept 1994 No. 58
EnviroSafe Cabinets is still open July 1995 No. 63
Evolution of Building Materials Nov 1995 No. 65
Explaining the House as a System Dec-Jan-1994 No. 54
Exterior Basement Drainage layers, June-July 1994 No. 57
Fibre Insulation Does it Work as Advertised? Aug-Sept 1993 No. 52
Fireplace Doors and Smoke Spillage July 1995 No. 63
Flexible Mouldings January 1995 No. 60
Floating Sub-Floor: the Nivell System January 1995 No. 60
Floor Manual, March 1995 No. 61
Floor Systems Testing Program; Nov 1995 No. 65
Flooring Problems: Telegraphing of Underlays, March 1995 No. 61
Forintek Evaluates VOCs from Composite Panels Aug-Sept 1994 No. 58
Formaldehyde January 1995 No. 60
Formaldehyde: common sources in a home January 1995 No. 60
Foundation Frost Damage Apr-May 1994 No. 56
Foundation Settlement - causes of Feb-March 1994 No. 55
Foundations Feb-March 1994 No. 55
Frame Plus computer software; Nov 1995 No. 65
Frost-Protected Shallow Foundations Apr-May 1994 No. 56
Frost protected shallow foundations, dynamic windows and passive solar design March 1995 No. 61
Gas Fired Baseboards June-July 1994 No. 57
Gas Service Standards Oct-Nov 1993 No. 53
Global Marketplace: Buyer Beware Feb-March 1994 No. 55
Global Warming:What are the Greenhouse gases? Dec-Jan-1994 No. 54
Gold for The Great Canadian Reno-Demo Project! Nov 1995 No. 65
Great Canadian Reno-Demo Project January 1995 No. 60
Great Canadian Reno Demo Project Oct-Nov 1994 No. 59
Great Canadian Reno-Demo Project Feb-March 1994 No. 55
Great Canadian Reno-Demo Project report July 1995 No. 63
Great Canadian Reno-Demo Project June-July 1994 No. 57
Great Canadian Reno-Demo Project Aug-Sept 1994 No. 58
Green Home: Planning and Building the Environmentally Advanced House (book review) Oct-Nov 1993 No. 53
Grey Water Systems: The Light Grey Option Feb-March 1994 No. 55
GreyWater Heat Recovery July 1995 No. 63
Guide to Resource Efficient Building Elements Fifth Edition (book review); Nov 1995 No. 65 The Clean Air Guide (book review); Nov 1995 No. 65
Hazardous Lands June-July 1993 No. 51
Healthy Buildings Resource Guide (book review) Dec-Jan-1994 No. 54
Healthy House Building (book review) June-July 1993 No. 51

Healthy Materials Aug-Sept 1994 No. 58
Healthy Household (book review) July 1995 No. 63
Healthy Materials: an introduction January 1995 No. 60
Heat Recovery Shower Aug-Sept 1994 No. 58
Heat Pumps Nov 1995 No. 65
Heat Recovery Shower July 1995 No. 63
High Performance Windows: Advanced House Window Performance May 1995 No 62
Homemade Money: How to Save Energy and Dollars in Your Home (book review) Nov 1995 No. 65
HOT-2000 Version 7.0 Oct-Nov 1994 No. 59
HOT-2000 Update (v7.1) July 1995 No. 63
HOT2000 results compared to actual, metered data Dec-Jan-1994 No. 54
Household Energy Use May 1995 No. 62
Housing Energy Design (book review); Nov 1995 No. 65
HRV Industry Changes Sept 1995 No. 64
HRV system efficiency June-July 1993 No. 51
HRV Update January 1995 No. 60
Humidity Meters Sept 1995 No. 64
Indoor Air Quality: Fact or Fiction? May 1995 No. 62
Indoor Air Quality Data Base, Oct-Nov 1994 No. 59
Indoor Air Quality in Swedish Housing Apr-May 1994 No. 56
Indoor air Quality, May 1995 No. 62
Infrastructure Guidelines Sept 1995 No. 64
Innovative Housing '93 Conference June-July 1993 No. 51
Insulated Building Forms Apr-May 1994 No. 56
Insulating Glass Guide Oct-Nov 1994 No. 59
Insulation: Total Thermal Resistance Values Aug-Sept 1994 No. 58
Ionisers: Do they do anything? Aug-Sept 1994 No. 58
Is Fibreglass a carcinogen? January 1995 No. 60
ISO 9000 March 1995 No. 61
Keeping basements dry Sept 1995 No. 64
Keeping Our Cities Cool June-July 1993 No. 51
Legionella in water systems Aug-Sept 1993 No. 52
Locating the Neutral Pressure Plane July 1995 No. 63
Manufactured Wood Floor Systems Testing Program, July 1995 No. 63
Masonry Fireplaces July 1995 No. 63
Masonry Heater Air Requirements Nov 1995 No. 65
Materials for a healthy environment: a Primer March 1995 No. 61
Measuring airflows: the Garbage Bag Test July 1995 No. 63
Mechanical Ventilation Assessment: 1993 Ontario Building Code May 1995 No. 62
Microwave Lumber Kiln Aug-Sept 1993 No. 52
Moisture content in lumber, Apr-May 1994 No. 56
Moisture content in lumber, June-July 1994 No. 57
Moulds in the Home Sept 1995 No. 64
Multi-unit R-2000 design evaluation guidelines July 1995 No. 63
National Building Code Changes Aug-Sept 1993 No. 52
National Energy Code for Houses, May 1995 No. 62
National Energy Code January 1995 No. 60
NCAT Wraps Up Energy-Related Toll-Free Help Feb-March 1994 No. 55
New Home Owner Manual; Nov 1995 No. 65
New Low-e Glass Sept 1995 No. 64
Non Toxic Termite Barriers Sept 1995 No. 64
North America's first "Green" panel board Apr-May 1994 No. 56
Northeast Sustainability Centre Feb-March 1994 No. 55
Nova Scotia Home Builders Welcome the World May 1995 No. 62
Ontario Green Products List, First Edition (book review); Nov 1995 No. 65
Passive Solar Heating June-July 1994 No. 57
Plastic Sheathing Membranes June-July 1993 No. 51
Plastic Gas Venting Update June-July 1994 No. 57
Plastic Vents on Fuel Fired Appliances: Caution! Apr-May 1994 No. 56
Plastic Gas Vents Sept 1995 No. 64
Plastic Vent Update; Aug-Sept 1994 No. 58
Plastic Gas Venting; Nov 1995 No. 65
Polybutylene water piping; Aug-Sept 1994 No. 58
Pre Fab Floor Bridging Nov 1995 No. 65
Preventing Basement Condensation Aug-Sept 1994 No. 58
Proposed Code Changes Oct-Nov 1993 No. 53
Quality Control: testing duct leakage May 1995 No. 62
Quebec Encourages Energy Conservation? Aug-Sept 1993 No. 52
R-2000: the Healthier Home January 1995 No. 60
R-2000 Program Update June-July 1993 No. 51
R-2000 Feedback Sept 1995 No. 64
R-2000Monitoring Data Review Sept 1995 No. 64
R-2000 New Energy Targets June-July 1994 No. 57
R-2000 New Technical Requirements: a Good idea? Apr-May 1994 No. 56
R-2000 and New Energy Codes: Is there a Difference? Aug-Sept 1994 No. 58
R-2000 New Technical Standard: Builders Respond Oct-Nov 1994 No. 59
R-2000 Indoor Air Quality Requirements Feb-March 1994 No. 55
R-2000 New Program Manager May 1995 No. 62
R-20 Windows May 1995 No. 62
R-2000 Float Home Oct-Nov 1994 No. 59
R-2000 Energy Credits Nov 1995 No. 65
Rammed Earth March (Construction Alternatives) 1995 No. 61
Reading an MSDS July 1995 No. 63
Recraft 90: The construction of a resource efficient house Dec-Jan-1994 No. 54
Recycling Used Materials Oct-Nov 1994 No. 59
Red Deer Renovation Demonstration June-July 1994 No. 57
Refrigerator Energy Saver June-July 1993 No. 51
Residential Ventilation Apr-May 1994 No. 56
Residential sprinklers, Oct-Nov 1994 No. 59
Residential Ventilation Systems Aug-Sept 1993 No. 52
resource-efficient construction what is it? Dec-Jan-1994 No. 54
Resource Efficiency? Affordable? Feb-March 1994 No. 55
Roofing and Waterproofing Membranes June-July 1993 No. 51
Rubber Pavers product revew Feb-March 1994 No. 55
SESCI Autonomous House Award June-July 1993 No. 51
Signage: Less is more March 1995 No. 61
Silver Georgie Awards for the Great Canadian Reno-Demo Project Sept 1995 No. 64
Simple House January 1995 No. 60
Simplified Method of Constructing Concrete Pier Footings Apr-May 1994 No. 56
Smart Valves: Intelligent water valves. Nov 1995 No. 65
Snap Together Plumbing Fittings Nov 1995 No. 65
Solar House Law March 1995 No. 61
Solar Shading Screens June-July 1993 No. 51
Space & DHW Combo System Guidelines June-July 1994 No. 57
Sprinklers July 1995 No. 63
Sprinklers Aug-Sept 1993 No. 52
Sprinklers Feb-March 1994 No. 55
Sprinklers Oct-Nov 1993 No. 53
STC (Sound Transmission Class) what is it? July 1995 No. 63
Steel Framing Dec-Jan-1994 No. 54
Stormwater Catch Basin Dec-Jan-1994 No. 54
Straw Bale Construction (Construction Alternatives) March 1995 No. 61
Stucco Finishes & Stucco Problems Oct-Nov 1994 No. 59
Sump Pump Performance Aug-Sept 1993 No. 52
Support Bracket for Decks and Landings at Foundation Walls June-July 1994 No. 57
Surfing the 'net: a primer: Browsing for Building Technology Information Sept 1995 No. 64
Sustainable Development: One Company's Example Apr-May 1994 No. 56
Timber-Tech House; Nov 1995 No. 65
TRC Bulletin Board, July 1995 No. 63
Understanding Ventilation (Book Review) May 1995 No. 62
Used Tires: a New Roofing Alternative? Oct-Nov 1994 No. 59
Ventilation Inspections Oct-Nov 1994 No. 59
Ventilation Efficient Equipment: Why We Don't See More? Oct-Nov 1994 No. 59
Ventilation handbook Aug-Sept 1993 No. 52
Ventilation - The Three faces of Apr-May 1994 No. 56
Ventilation (Effective): How much air is needed? Oct-Nov 1994 No. 59
Ventilation: Ontario code requirements Aug-Sept 1993 No. 52
Water tank heaters Dec-Jan-1994 No. 54
Water Conservation Oct-Nov 1993 No. 53
Where there's fire, there's not always smoke! Aug-Sept 1994 No. 58
Window Ratings Feb-March 1994 No. 55
Window Innovations '95 July 1995 No. 63
Window purchasing checklist Feb-March 1994 No. 55
Window Durability June-July 1993 No. 51

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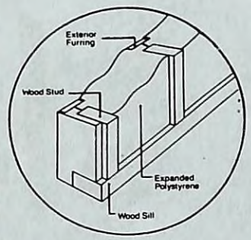

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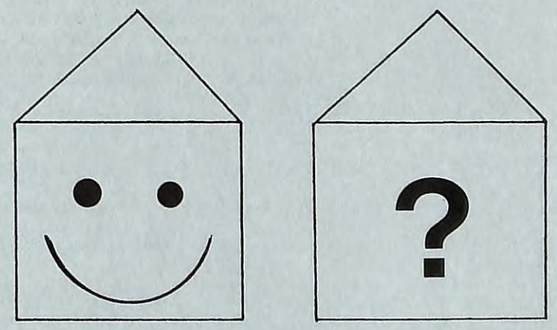

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